SHORT RESUME/ SYNOPSIS OF PH. D TOPIC

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"STUDIES ON CESTODE FAUNA OF VERTEBRATES"

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1. A BRIEF RESUME OF PROPOSED WORK / PROBLEM

Parasites are one of the most neglected components in evaluations of biodiversity; however, the simple observation that each free-living animal harbours at least one parasite species immediately suggests that the number of parasite species is at least equal to the number of non-parasitic species and probably greater than it. Parasites are certainly a major component of biodiversity and ecosystems and thus deserve appropriate interest. Cestoda is the name given to a class of parasitic flatworms of the phylum Platyhelminthes. Its members live in the digestive tract of vertebrates as adults and often in the bodies of invertebrates like insects and arthropods as juveniles. The adult tapeworm usually inhabits the alimentary canal of its host, attaching to the mucosa by means of a scolex. They penetrate the intestinal mucosa with the scolex causing inflammation and nodules (Heidenreich, 1997). Tapeworm infection of the intestine occurs mainly when people eat raw or undercooked contaminated pork, beef, or freshwater fish or, for the dwarf tapeworm, contaminated food or water. Helminths are an important group of pathogens, which cause infection and diseases of Vertebrates. Keeping view in mind about importance of vertebrates like fishes, domestic fowl, goat and sheep for human, The present work is undertaken to study the Cestode fauna of vertebrates from Nanded.

2. Introduction To Proposed Research Topic:

Vertebrate animals represent a diverse and ecologically important component of all life on earth. They contribute to the vast majority of the described biodiversity on our planet and can be found in virtually every ecosystem from the deep ocean to the tops of our highest mountains. They are integral to ecosystem functions at scales small and large.

Cestoda is a class of parasitic worms in the flatworm phylum (Platyhelminthes). Most of the best-known species are included in the subclass Eucestoda. Tapeworm, also called cestode, any member of the invertebrate class Cestoda (phylum Platyhelminthes), a group of parasitic flatworms containing about 6,000 species. Tapeworms, which occur worldwide and range in size from about 1 mm (0.04 inch) to more than 15 m (50 feet), are internal parasites, affecting certain invertebrates and the liver or digestive tracts of all types of vertebrates including humans, domestic animals, and other food animals, such as fish. Some attack a single host, others require

one or two intermediate hosts as well as a final, or definitive, host during their life cycle. The disease caused by tapeworms is known as cestodiasis.

Cestodes are ribbon-like worms as adults, known as tapeworms. Their bodies consist of many similar units known as proglottids. Tapeworms are bilaterally symmetrical (*i.e.*, the right and left sides are similar). Some consist of one long segment; others have a definite head, followed by a series of identical segments called proglottids. The head, or scolex, bears sucker and often hooks, which are used for attachment to the host. The body covering is a tough cuticle, through which food is absorbed. There is neither a mouth nor a digestive tract. Tapeworms also lack a circulatory system and an organ specialized for gas exchange. Most tapeworms are hermaphroditic (i.e., functional reproductive organs of both sexes occur in the same individual). They are usually self-fertilizing, and gonads of both sexes also occur within a single proglottid.

All 6,000 species of Cestoda are parasites, mainly intestinal; their definitive hosts are vertebrates, both terrestrial and marine, while their intermediate hosts include insects, crustaceans, molluscs, and annelids as well as other vertebrates. *T. saginata*, the beef tapeworm, can grow up to 20 m (65 ft); the largest species, the whale tapeworm *Tetragonoporus calyptocephalus*, can grow to over 30 m (100 ft). Species with small hosts tend to be small. For example, vole and lemming tapeworms are only 13–240 mm (0.5–9.4 in) in length, and those parasitizing shrews only 0.8–60 mm (0.03–2.36 in).

Vertebrates are hosts to a number of helminth parasites. A tapeworm is a flat, parasitic worm that lives in the intestines of an animal host. It commonly infects many different animals, including humans, livestock and domestic cats and dogs (usually meat-eating mammals.). Like other parasites, the mature tapeworm can only survive inside the host animal, feeding off of the host's own nutrients. The head attaches to the inside of your intestines and absorbs nutrients from the food digesting there. Cestode infections in animals are important because several species are zoonotic, causing cysticercosis and hydatidosis in man, and because of the economic losses incurred due to infections in livestock. For that reason, the present work is proposed to investigate the Studies on Taxonomic studies of Cestode fauna of Vertebrates from Nanded District M.S. India.

3. Survey or Review of Literature and Development in the Relevant Subject:

Parasitological investigation and research performed has been reviewed through study of available literature. Considerable works mainly on systematics, Morphotaxonomy, nature of infestation and pathology of different groups of Vertebrates have been done. Till date, around 30,000 species of helminth parasites have been recorded from different vertebrate host. Many workers studied different aspects of taxonomic diversity of helminth communities in the vertebrates. There are some pioneer workers in the world. Notable contributions to the biology of Helminthes field were made by Yamaguti, S. (1934, 1958, 1959,1961), Woodland (1923, 1924), Anderson (1976), Wardle, R. A., McLeod, J. A. and Radinovsky, A. (1974) etc. In India, some of helminthologists who made extensive work in this fields are Johri (1959), Moghe (1925), Bhalerao (1932), Thapar, G.S. (1938), Sood, M.L.(1968) Ramadevi (1973), S.M.Ali (1956), M.Z.Chishti (2004), R.Madhavi (2007), Nama, H.S. (1974), S.P.Gupta (1953), Pandey, K.C.(2007), Tandon V. (2005), H. S. Singh (1995), Malhotra & Capoor (1980), Shinde, Jadhav, Hiware, Nanware, Bhure & his group (1970, 1980, 1984, 2005 & 2006,2008,2015,2016,2020) etc.

4. Objectives of the Research and Proposed Hypothesis: -

The objectives of the proposed study are as follows:

- To make survey of different vertebrate animals from Nanded District for Biosystematics of Cestodes.
- Taxonomic identification of Cestode Fauna of Vertebrates.
- To study Diversity & Population dynamics of Cestode Fauna of Vertebrates for incidence, intensity, density and index of infections.
- To study Biochemical Profile (Glycogen, Protein and Lipid contents) of Cestodes and its host tissue of vertebrates.

5. Methodology to be Used and Adopted:

Helminths collected from vertebrate host will be identified by -

1. Systema Helminthum Vol.I to III- By Yamaguti, S. (1958,1959, 1961)
2. Helminths, Arthropods and Protozoa of Domesticated Animals-By Soulsby E.J.L. (1982)
3. Keys to the Cestode Parasites of Vertebrates- By Khalil, Jones and Bray (1994)
4. Handbook of Tapeworm identification –By Gerald D. Schmidt (1934)

- Population Dynamics Will be recorded and calculated according to Margolis et.al., 1982.

- Biochemical contents will be estimated by following standard methods.
  1) Glycogen will be estimated by Kemp et. al., method (1954)
  2) Protein will be estimated by Gornall et. al., method (1949)
  3) Lipid content will be estimated by Folch et.al., method (1957)

Study Area:- Different collection sites of host in Nanded District of Maharashtra State, India.

Nanded is one of the historical places in the Marathwada region of Maharashtra State. It is situated on the north bank of the Godavari River. Nanded district borders Latur district, Parbhani district and Hingoli district to the west and Yavatmal district to the north. The district is bordered by the Nizamabad, Kamareddy, Nirmal and Adilabad districts of Telangana state to the east and Bidar district of Karnataka state to the south.

6. Importance of study:

- **International Status-**

Due to the global incidence of helminth infections in vertebrtaes, their detailed study would bear natural importance for handling these infections. The helminth parasite fauna of vertebrates, its frequency and distribution have been studied in many parts of the world. Helminth parasite severely decreases the population of vertebrate animals worldwide. If persons consumes such infected under-cooked flesh of vertebrate host. It leads to high mortality thought world. The World Health organization (WHO) has estimated that number of peoples currently infected with Helminths. Many vertebrates (Fishes, Goat, Sheep, Gallus domesticus) constitute a major component of diet for the people. Helminths are an important group of pathogens, which cause infection and diseases of vertebrates, their importance being related directly to the host that may affect the general public health.

- **National status:-**

Vertebrates are parasitized by four major groups of helminths (worms). Two of the groups, trematodes, or flukes, and cestodes, or tapeworms, fall within the Phylum Platyhelminthes. The other two groups are the nematodes, or roundworms, (Nematoda) and the acanthocephalans, or thorny-headed worms (Acanthocephala). Many of these parasites have been documented as causes of morbidity and mortality in Fishes, wild birds and mammals. Helminth parasites of vertebrates and their infections are matter of concern since they affects the productivity by decreasing their reproductive potential, market and nutritive value. Infection of

these parasites may result in poor growth, postpone sexual maturity and mortality of animals, and cause human and animal diseases due to weak association of host and parasites. Various workers in different parts of the country have studied the diversity of helminth fauna in India. It is expected that, Application of therapeutic measures to get rid of these pathogens requires a sound base of taxonomy.

- **Regional Status-**

The helminth parasite fauna of vertebrate hosts of Indian region ranks amongst the best characterized parasite faunas in World. During the past decade our knowledge of helminth parasites of vertebrates has increased dramatically. Knowledge of particular host determines identification of parasite with marked host and tissue specificity. Freshwater fishes, domestic fowl, Sheep and goats are good sources of proteins. Several peoples consume flesh of these host because of nutritional value but helminth affects the health of such hosts and if we consume such kind of infected vertebrates (fishes, fowl and sheep and goat) causes diseases. The present study will be able to increase understanding about Taxonomic studies of Cestode parasites of Vertebrates from Nanded Region, which help to adopt control strategies against such infections.

- **Scope of Study-**

Parasitic diseases are the limiting factors in production of hosts. Helminth parasites have been a major cause of ill-health and loss of productivity in different parts of the world, including India. Endoparasites affect the intestine and cause nodules and severe enteritis, thus impairing the absorbing power of the intestine for nutrients and vitamins from the host (Hayat & Hayat, 1983). To provide a complete record of knowledge, this study is aimed to analyze the taxonomic studies of cestode fauna of vertebrates.

7. Proposed work Plan with a Tentative chapter scheme:

1. Introduction
2. Preface
3. Review of Literature
4. Geographical Background of Research Area
5. Materials and Methods
6. Result & Discussion
   I) Taxonomy of Cestode Fauna of Vertebrates
   II) Diversity and Population Dynamics of Cestode Fauna of Vertebrates
   III) Biochemical Studies
   IV) Summary & Conclusion
7. Bibliography

8. Proposed work Plan/ Formulation and Structure of Study:

First Year: - Review of Literature, Referencing, Research methodology, visit to various localities of Nanded district for collection of cestode parasites of vertebrates. Recording the obtained data for Population dynamics study. Collection and preservation of Cestode parasites. To study Biochemical Profile (Glycogen, Protein and Lipid contents) of Cestodes and its host tissue.

Second Year: - Collection of cestodes from different vertebrates from different collection sites of Nanded. Fixation, preservation, dehydration, staining and whole mount preparation of cestode parasites. To record the obtained data for population dynamics study. Data analysis. To study Biochemical Profile (Glycogen, Protein and Lipid contents) of Cestodes and its host tissue.

Third Year: - Collection, preservation, staining, mounting and identification of cestodes on the basis of Systema Helminthum by S. Yamaguti. Morpho-taxonomic studies on cestode parasites of vertebrates. To record the obtained data for population dynamics study. Data analysis. To study Biochemical Profile (Glycogen, Protein and Lipid contents) of Cestodes and its host tissue.

Fourth Year: -Camera Lucida line drawings, morphometery, photomicrography, data analysis, drafting, typing and submission of thesis.

9. Expected Outcome:

Helminth infections inflict negatively on the production and well-being of animals including Freshwater fishes, domestic fowl, sheep and goats. After the completion of this study, It will help to know the Taxonomic diversity of cestode parasites of vertebrates from Nanded District M.S. India. The baseline information will helpful for successful formulation and implementation of an effective control strategy.

10. References:

Ali, S.M. (1956): Studies on the nematode parasite of fishes and birds found in Hydrabad State. *Indian Jour. Helminth 8:1-83.*

Anderson R.M. (1976): Seasonal variation in the population dynamics of *Caryophyllacus lacticeps. Parasitology 72: 281-395.*

BALI, H. S. (1976): A survey of helminth parasites of sheep (Ovis aries) in Jammu and Kashmir. *J. Anim. Hlth Prod. 4: 25-32*

Bhalerao G.D (1932): General account of Helminth parasites affecting domestic animals in

India with methods of collection preservation, staining etc. *India J. Vet science and animal Husb. 2: 1-28.*

Bhalerao,G.D. (1935): Helminth parasites of domesticated in India. I.C.A.R. monograph no. 6. Manager of publication Govt. of India, New Delhi p.p.1-352.

Bhure Dhanraj Balbhim (2008): Faunal diversity of helminth parasites of freshwater fishes from Maharashtra State, India. *Ph.D. Thesis, Dr. B. A.M.U.Aurangabad, M.S.India. pp.1-178.*

Bhure Dhanraj Balbhim, Nanware Sanjay Shamrao, Barshe M.U. and Deshmukh V.S. (2016): Studies on Faunestic Diversity and Distribution of Cestode Parasites of Certain Vertebrates from Marathwada Region. *Asian Journal of Agriculture & Life Sciences. Vol. 1(2), April 2016: 5-8*

Bhure Dhanraj Balbhim, Nanware Sanjay S. and Dhondge R.M. (2020): Studies on Faunestic Diversity and Distribution of Piscean Tapeworm. *Book Chapter, Being Humans: Ethics and Environment. Pp 144-150.*

Chishti Et.Al. (2004): Seasonal occurrence of Helminth Parasites in Schizothorax in Dal Lake Kashmir. *Jr. of Parasitic Diseases Vol.28(1):23-28.*

DESHMUKH, A.L. (1983): Studies of helminth parasites of vertebrates from Maharashtra state. Ph.D. thesis, Marathwada, University , Aurangabad. M.S. India. Pp. 1-210

Dhar R. L. (1972): *Studies on the helminth parasites of fishes of jammu and Kashmir [Ph.D. thesis]*, University of Kashmir, Srinagar, Indian, 1972

Folche, J., Lee, M. and Sloane, S. G. H.(1957): A simple method for the isolation and purification of total lipids from animal tissues. *J.Biol.Chem*. 1957, *226, 497-509.*

Gerald D. Schmidt (1934): Handbook of Tapeworm Identification. CRC Press, Inc. Boca Raton, Florida. Pp 1-675.

Gupta, S. P. (1953): Trematode parasites of freshwater fishes.

Hoffman GL. (1967):*Parasites of North American freshwater fishes. Berkeley: University of California Press; 1967. p. 486*

Jadhav, B. V. and Bhure, D. B. (2006) : A revision of the genus *Lytocestoides* Baylis, 1928 (Cestoda-Caryophyllidea) from freshwater fishes in Maharashtra. *Flora and Fauna vol-12, N-1, pp. 9-16.*

K. C. Pandey (2007): Fish parasites: Taxonomy capacity building. *Manual of workshop. On parasites : Taxonomy Capacity building Dept. of Zoology Andhra University, Visakhapatnam during 23-24 feb. 2007 pp. 5-7.*

Khalil L.F, Jones A. and Bray R.A (1994): Keys to the cestodes parasites of vertebrates. *CAB International Pub. U.K. pp.1-751.*

Malhotra, S. K., Capoor V. N. and Shinde G. B. (1980): Introduction of taxonomic device to evaluate a new Proteocephalid cestode. *Gangesia sonhensis* n. sp.from freshwater fishes of Gahrwal, Himalaya with revised key to species of Genus *Gangesia. Marath, Univ. J. Sci. (Nat. Sci.)19 (12): 41 – 52.*

Margolis, L., G.W. Esch, J.C. Holmes, A.M. Kuris and G.A. Schad (1982): The use of ecological terms in parasitology (Report of an ad hoc committee of the American Society of Parasitologists*). J. Parasitol., 68, 131-133*

Moghe, M.A. (1925): A supplementary description of *Lytocestus indicus.* (syn. *Caryophyllaeus*) from India. *Parasitology (23) 84-87.*

Nama H.S.(1974): On Certain Cestodes of Rajsthan, *Indian J.Zool.2(1):33-36*

R. Madhavi (2007): Collection, fixation , staining and identification of digenetic trematodes. *Manual* of *workshop on Parasites Taxonomy, Capacity Building Dept. of Zool, Andra Uni., Visakapatnam during 23-24 Feb 07 pp 65-74*

Ramadevi, P. (1973): On *Senga visakhapatnamensis* n.sp. (Cestoda - Pseudophyllidea) from the intestine of the freshwater fish *Ophiocephalus puncatus* Bloch.. *Rivista Di. Para Vol. 34, N-4 281-286.*

Rao K.H. (1959): On Ptychobothrium cypseluri n.sp. (Cestoda-Pseudophyllidea) from Flying Fish Cypselurus poecllopterus caught of Waltair. J.Hel. (33): 267-272

Schimidt G.D. and Roberts L.S. (2000): Foundations of parasitology. 6. Boston: Mc Graw-Hill International Editions; 2000

Shinde, G.B. and Jadhav, B.V. (1980): New tapeworm *Senga godavari* from *Mastacembelus armatus*, Aurangabad, M.S. India. *Biology Vol. II (40: 46-48).*

Singh, H. S. Agarwal, S; Kumar, K. and Sharma B, (1995): Population dynamics, host specificity, spatial distribution and morphology of *Hamatopedun cularia wallagonius* sp.nov *Uttar Pradesh J. Zool (15) 108-116*

Sobecka E. and Słomińska M. (2007): "Species richness, diversity and specificity of the parasites of bream *Abramis brama* (L.) and perch *Perca fluviatilis* L. in the estuary of the Odra River, Poland," *Helminthologia, Vol. 44, No. 4, pp. 188–192.*

Sood, M. L. (1968): Some nematode parasites from freshwater fishes of India. *India. J. Hel. 20 83-110*

Woodland WNF. (1923):. *Quarterly Journal of Microscopical Sciences (New series). 67: 435-472.*

Woodland W. N. F. (1924): On a new Proteocephalidae from Indian freshwater fishes.

Yamaguti, S. (1934). Studies on the helminth fauna of Japan. Part 2. Trematodes of fishes. *I. Japanese Journal of Zoology. 5: 249-541.*

Yamaguti S. (1958): Systema Helminthum. Vol. I & II. *Digenetic trematodes of vertebrates. Inter-Science, New York.* 1575p.

Yamaguti S. (1959): Systema Helminthum Vol. II. The Cestode of vertebrates. *Inter Science Publ. New York and London 1-860.*

Yagamuti S. (1961): Systems Helminthum Vol. III Part 1 and 2. *Nematode Interscience New York.* 1261.

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